

### **Remarks**

Claims 11-21 are pending. Favorable reconsideration is respectfully requested. No claim amendments are made.

The sole rejection is under 35 U.S.C. § 103(a) over Fukushima et al. U.S. 6,306,502 ("*Fukushima*"). Applicants respectfully traverse this rejection.

*Fukushima* discloses that there is a continuing need for providing scratch resistant coatings. To this end, *Fukushima* discusses numerous attempts of prior workers to increase abrasion resistance by incorporation of silica into the coating composition. *Fukushima* further indicates that the silica should be organically modified, as was done by Chung (U.S. 4,348,462 ("*Chung*")), cited in col. 2, line 1 of *Fukushima*). The silicas in this reference were modified by reaction with a methacryloxytrialkoxysilane, just as did *Fukushima*. However, *Fukushima* indicates that the coatings prepared from these modified silicas, modified by the same modifier used by *Fukushima*, methacryloxypropyltrimethoxysilane, were of insufficient hardness, abrasion resistance, etc.

To obtain better physical properties, *Fukushima* did not experiment with different modified silicas; he used the same silicas as Chung did almost 20 years earlier. Rather, to increase hardness and scratch resistance, *Fukushima* changed the resin system to one containing a poly(acryloyloxyalkyl)isocyanurate and a urethane poly(meth)acrylate having an aliphatic skeleton.

Thus, the modified silicas used by *Fukushima* (and others) have been known since at least 1982, the issue date of *Chung*, and since that time, no one, including *Fukushima*, had any recognition that changing the functional groups on the silica made any difference. According to *Fukushima*, it is not the silica which can be varied to produce higher hardness, but the curable resin. In other words, changing the silica functionalization was not recognized as a result effective variable.

Applicants, however, have surprisingly and unexpectedly discovered that silicas functionalized by alkoxy- $\alpha$ -silanes bearing unsaturated groups produce a much higher level of hardness than the modified silicas used by *Fukushima*, even though the modifying group contains the same polymerizable species, *i.e.* a methacryloxy group. This result was entirely unpredictable.

As indicated in Applicants' prior response, *Fukushima* discloses a plethora of potential unsaturated alkoxysilanes which might be used in modifying silica, which is a superset of those disclosed by *Chung*, who disclosed most of these unsaturated alkoxysilanes. Of all the modifying agents disclosed by *Fukushima*, only a small fraction are  $\alpha$ -silanes, and *Fukushima* never used any of these, nor did he call out any of these by chemical name. None of the named silanes, for example those at column 5, lines 7-20, are  $\alpha$ -silanes.

The talisman of obviousness is whether the reference directs the skilled artisan to the claimed invention. *Fukushima* does not do this. Rather, *Fukushima* indicates that the secret to higher hardness coatings lies in the resin system, not the modified silica.

The Office criticizes the Briehn Declaration for failing to provide objective evidence that Applicants' coatings, containing silica modified by  $\alpha$ -silanes, satisfies the long felt need for higher scratch resistance in the industry. Applicants respectfully submit that this is not correct. The long felt need for higher scratch resistance coatings cannot be argued with — it is well documented by the Examiner's *Fukushima* reference. It is also attested to by Dr. Briehn, who is well skilled in the art and well aware of the need for higher scratch resistance. Until cars and other coated objects are faced with literally diamond hard coatings, this long felt need will continue. However, every increase in scratch resistance will be important. The subject invention satisfies this long felt need, at least temporarily, since a harder, more scratch resistant coating is provided. This is the reason for the research which culminated in the *Chung* and *Fukushima* patents, for example. That the subject invention has provided for a better solution to this long felt need, in the form of coatings with higher scratch resistance, is beyond argument, as shown by the examples and comparative examples.

If *Fukushima* had completely satisfied this long felt need, others, like Dr. Briehn, would not have directed research in this direction. The objective evidence is there: the subject invention coatings have much higher scratch resistance due to the use of their  $\alpha$ -silane modified silicas. Dr. Briehn also states, *albeit* subjectively, that this is the case. However, Dr. Briehn's subjective evaluation is based, not only on a high level of experience in this field, but also on the objective test results. Both the test results, because they speak for themselves, and Dr. Briehn's opinion, because it is based on extensive experience in the field, are entitled to great weight.

The Office states that

[w]hen the prior art fully describes the claimed invention, a showing of unexpected results cannot be the basis for patentability.

Office Action, p. 5. Applicants respectfully submit that this is legally incorrect. If this were a case of anticipation under 35 U.S.C. § 102, it would be correct. However, this is not a case of anticipation, but a rejection for obviousness under 35 U.S.C. § 103(a). In such rejections, surprising and unexpected results require a finding of patentable subject matter. It is rare when there is an invention so different that there is not some overlap between portions of the claimed invention in the prior art. Most inventions are "improvement" inventions which, due to a limited selection of parameters disclosed by the prior art, achieve surprising and unexpected improvements which render these inventions patentable.

The Office also criticizes Applicants' comparative results, since one of Applicants' own examples showed a higher loss of gloss (25%) relative to Comparative Example B (24%). Applicants respectfully submit that this characterization is ill-founded.

The Example to which the Office refers is Example 3. Example 3 should be compared with Comparative Example 2. Both examples functionalized silica in the same solvent, Example 3 using methacrylatomethyltrimethoxysilane, an  $\alpha$ -silane, while Comparative Example 2 used methacrylatopropyltrimethoxysilane, the silane used by *Fukushima*, which is not an  $\alpha$ -silane. Comparative Example 2 used the same silica organosol as did *Fukushima*. These two examples are thus directly comparable: they are side-by-side comparisons. The Example 3

coating showed a loss of gloss of 25%, while the comparative example showed a loss of gloss of 43%, some 72% higher on a relative basis.

The "new inventive example" in the first Briehn Declaration uses an aqueous silica dispersion in reacting with the  $\alpha$ -silane, while Comparative Example B also used an aqueous silica dispersion, but with the methacrylatopropyltrimethoxysilane of *Fukushima*. These comparisons also showed that the claimed silicas had a significant increase in scratch resistance, 26% higher than when the silica was functionalized with *Fukushima*'s preferred functionalizing silane. These results do show a surprising and unexpected increase in scratch resistant.

The reason why this increase is surprising and unexpected is that both *Chung* and *Fukushima* indicate that an increase in scratch resistance is obtained by functionalizing silica with a photocurable or addition curable, ethylenically unsaturated group, which then chemically bonds the silica to the polymer matrix. However, *Fukushima* indicates that if one desires to increase hardness, it is the resin system which must be changed, not the silica. Both the subject invention silicas and the *Fukushima* silicas both bear the same unsaturated methacrylate group. Why then should one be able to prepare harder coatings than the other? *Fukushima* does not direct the skilled artisan towards experimenting with different silicas. Rather, *Fukushima* directs the skilled artisan to different resin systems. That the presence of a methylene "spacer" between the methacryloxy group and the silicon of the alkoxysilyl group would make any difference is neither taught nor suggested by the prior art; it is truly unpredictable, and both surprising and unexpected.

The Office also criticizes the scope of Applicants' showing, since Applicants' formula (I) encompasses many silanes. This is only partially correct. The formula of *Fukushima* includes many, many silanes. Applicants' silanes are much more limited. First, they are limited to  $\alpha$ -silanes by the presence of the  $-CR_2^3-$  group between the Si and the "A-D-C" grouping. Second, all these silanes are characterized by having an A group with at least one lone electron pair on an electronegative group. It is this linkage which confers the special properties to the  $\alpha$ -silanes. Dr. Briehn states in his second Declaration that the examples and comparative examples show unexpected and surprising results which are commensurate with the scope of the

claims (§5 of Briehn II). On page 6 of his Declaration, Dr. Briehn provides a scientific basis for why other  $\alpha$ -silanes would be expected to work as well as the ones actually exemplified. Dr. Briehn is a noted scientist and his conclusions are based on sound technological footing. If the Office disagrees with Dr. Briehn's scientific conclusions, it is incumbent on the Office to provide references or a Declaration under 37 C.F.R. § 104(d)(2) to contest these findings. Otherwise, they must be accepted.

In all fairness to Applicants, silicas modified with silanes bearing ethylenically unsaturated groups have been known since at least 1982, the issue date of *Chung*. In all that time, no one has suggested that an  $\alpha$ -silane bearing an unsaturated group should be used to modify silica rather than a conventional silane. If it were obvious to do so, it would have been done long prior to the 2004 filing date of Applicants' priority document. This is some 22 years from the *Chung* disclosure, all during a time wherein improved scratch resistance was a continuing need in the industry. *Fukushima* was aware of *Chung*, having cited *Chung* in his disclosure. Yet *Fukushima* did not believe that further modifying silica would have any benefit. Instead, he proposed to modify the resin system instead.


For all these reasons, Applicants submit that the claimed invention is patentable over *Fukushima* under 35 U.S.C. § 103(a), and respectfully solicit withdrawal of this rejection.

Applicants submit that the claims are now in condition for Allowance, and respectfully request a Notice to that effect. If the Examiner believes that further discussion will advance the prosecution of the Application, she is highly encouraged to telephone Applicants' attorney at the number given below.

Please charge any fees or credit any overpayments as a result of the filing of this paper to our Deposit Account No. 02-3978.

Respectfully submitted,

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